Plastics—Products of Ever-Widening Utility

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THE past quarter of a century, and more particularly the last decade, has witnessed a phenomenal growth in the manufacture of organic plastics in the United States, until today the many and varied uses of such products assures a permanent and important place in our economy for this relatively new industry.

The increasing application of plastics in industry and their utilization in every-day life explains their advance to a position of importance, not only in our domestic industry, but in world commerce. By way of illustrating the wide variety of uses of these products, we may consider in detail two groups—synthetic resins and cellulose plastics. The importance of the synthetic resin plastics is becoming more and more apparent through their use in such commonplace articles as bottle caps, radio parts, timing gears, and furniture, as well as their employment in the automobile, electrical, and marine industries, and in the manufacture of printing inks, varnishes, and lacquers. In the cellulose group, nitrocellulose or pyroxylin plastics, under trade names such as celluloid, pyralin, viscoloid, fiberloid, xylonite, and the like, are well known to the public through their utilization in the manufacture of toilet ware, automobile curtains, fountain pens, spectacle rims, piano keys, shoe-heel covering, toys, and various other articles.

In addition, the protein plastics such as those made from casein and soybeans, constitute an important class though they are not treated in this article. A large motor-car company employs soybean casein plastics in the manufacture of distributor covers, distributor bases, light switch handles, gear shift lever balls, window-trim stripe, and other accessories.

Not only are new uses being found for the older types of plastics, but new materials from new sources are being added to the ever-growing list and, since color can be incorporated with them, their appeal to beauty finds expression in articles having all the rainbow hues.

The United States plastics industry is of such a diversified nature and its products have so wide a field of application that adequate data showing production in all branches and distribution through all channels are not available; therefore, it is impossible to present a picture that will mirror all of its many ramifications. Furthermore, practically every day sees some development in the way of a new product or new application, all of which tend to change the situation. For the purpose of this article the discussion is confined mainly to the production and use of the two principal types—synthetic resins and cellulose plastics.

Synthetic Resins

The development of uses and markets for synthetic resin products has been largely the result of American inventive genius and merchandising skill. The utilization of the pioneer type—the phenol-formaldehyde resins—was followed by the development of the coumarone and indene resins, the tar acid, alkyd and resorcinol resins, and others representing the coal-tar group, and subsequently the noncoal-tar organics, the urea, thio, vinyl, furfural, and other resins.

Production of synthetic resins which lend themselves so admirably to the manufacture of such a wide line of finished products, ranging from jewelry to building materials, passed the 100 million pound mark for the first time last year, having more than doubled since 1933. Eighteen years ago the output was about 3 million pounds per annum. (See figure 1.)

Approximately 90 percent of all synthetic resins produced in the United States are of coal-tar origin, the remainder being made of urea and other materials.

Production of synthetic coal-tar resins aggregated 89½ million pounds in 1935, according to the United States Tariff Commission, compared with 56 million pounds during the preceding year and 41½ million pounds in 1933. A total of 64,641,000 pounds, valued at $12,191,000, was sold to other manufacturers in 1935, the remainder being consumed by the producers. During 1936 the sharply rising trend of production has continued and final figures for the current year will show a large increase over the latest total presented on the accompanying chart.

The synthetic resin industry received a great impetus from radio development, particularly in the early stages when receiving sets were being assembled by "amateurs" and almost every set was faced with a synthetic resin panel, and later when radio manufacturers began utilizing such materials for the manufacture of cabinets.

The radio industry, however, has been only one of the many that contributed to the growth of synthetic resin production; in fact, 53 percent of the coal-tar resin production was consumed in 1935 in the manufacture of paint, varnish, and lacquers. However, it may be said that almost every branch of manufacturing has made extensive use of the material. Increased demand for synthetic resins, chiefly of coal-tar origin, is primarily responsible for the increased consumption of both phenol and cresylic acids in recent years. This is true also of refined naphthalene, phthalic anhydride,

glycerine, and formaldehyde. In 1935, production of phenol amounted to 43,418,000 pounds, which was double that of 1930, and sales aggregating 34,575,000 pounds were valued at $3,433,000.

Cellulose Plastics

Cellulose plastics are derived from cotton linters or purified wood pulp initially treated with acids and subsequently with solvents, from which results a viscous liquid or a plastic mass which may be moulded into sheets, blocks, rods, or tubes for ultimate conversion into familiar articles and uses.

One of the outstanding, yet probably not so well known nitrocellulose outlets, is the lacquer industry. Since 1923 the development of this industry has had a spectacular influence on the finishing operations for automobiles, furniture, etc., and spray finishing generally. Imitation leather, which is usually a pyroxylin coated fabric, affords another major outlet.

Cellulose acetate plastics have only recently begun to assume commercial importance, although considerable development work has been done in this field during the last 30 years. The increase in the use of cellulose acetate sheeting, as the plastic filler sandwiched between two glass plates to form safety glass, has been spectacular. Since 1932, before which its use for this purpose was negligible, acetate has almost entirely displaced pyroxylin for this purpose. Cellulose acetate films include not only the slow-burning safety-film used for home movies, X-rays, etc., but also a transparent wrapping material which provides a close, even, and uniform fit in packaging.

United States production of cellulose plastic products in recent years, according to data compiled by the United States Department of Commerce, Bureau of the Census, from figures supplied by manufacturers representing the entire industry is shown in the following table:

Production of Nitrocellulose and Cellulose Acetate (Aceto-Cellulose), 1933–36

Year	Nitrocellulose			Cellulose acetate
	Sheets	Rods	Tubes	sheets, rods, and tubes
	Pounds	*Pounds*	*Pounds*	*Pounds*
1933	9,503,222	1,981,812	500,039	2,482,111
1934	9,771,711	1,779,605	817,517	4,826,347
1935	12,528,947	2,739,259	936,112	10,504,003
First 3 months:				
1936	7,707,153	1,536,825	622,509	6,110,272
1935	8,217,270	1,900,139	552,228	7,677,875

In considering the table, attention is directed to the fact that the figures refer exclusively to the raw material phase of sheets, rods, and tubes. It is likewise well to bear in mind that cellulose plastic solutions (primarily for lacquers), smokeless powder, and rayon are likewise

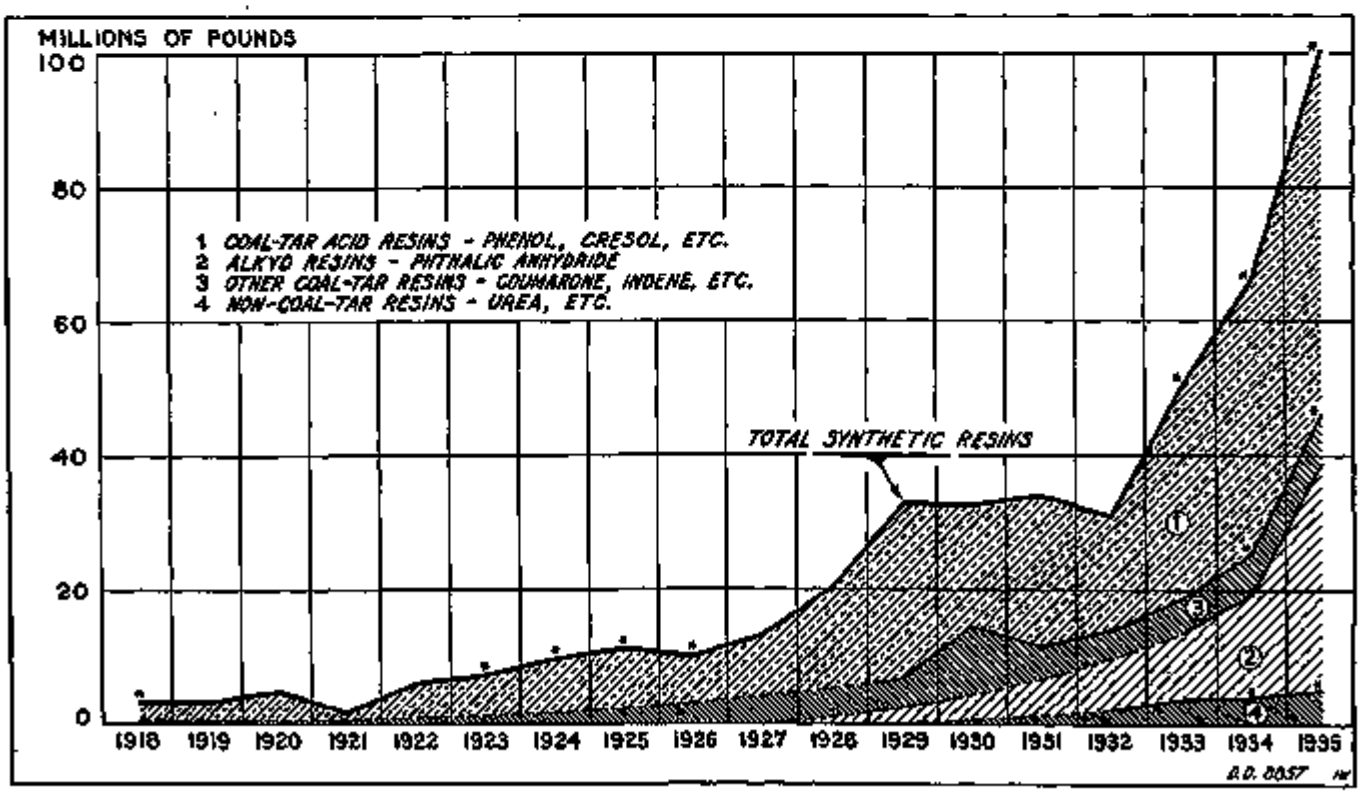

Figure 1.—Synthetic Resin Production

NOTE.—For years marked with an asterisk (*), the figures are either partly, or entirely, estimated. For the period 1933 through 1935, only two companies were operating and hence the figures could not be published without revealing the operations of the individual concerns. In other years, estimates are as follows: 1933, coumarone and indene resins and resins derived from maleic acid; 1934, coumarone, indene and sulfonamid resins, and all noncoal-tar resins except urea resin; 1935, coumarone and indene resins, and all noncoal-tar resins except urea resin. The dotted lines indicate the probable growth for the various items, starting in the years specified.

cellulose plastics, but are not treated in this article. Reference is made to them, however, to facilitate visualization of the magnitude of the cellulose plastics industry as a whole, which in the aggregate has so materially increased the demand for processing chemicals. For example, the production of requisite organic acids, solvents, stabilizers, and miscellaneous organic chemicals has grown many fold over the past decade, due in part to wider use and acceptance of cellulose plastics.

The table gives an indication only of the trend in the past 4 years. Data are available, however, from the Bureau of the Census reports to construct a chart (see fig. 2), which shows the trend over a somewhat longer period. It will be noted that production in 1935 exceeded by a considerable margin the 1929 output, while, for the first 8 months of 1936, there was an increase of 14 percent over the comparable period of 1935. The growth of aceto-cellulose production during the past few years has been rapid, and during 1936 practically all of the increase in production has been from this source. In 1933, the first year that the output of aceto-cellulose was reported separately, this product contributed 17 percent of the total production whereas during the current year it represented 43 percent. If the present rate of increase continues, production of aceto-cellulose will approximate that of nitrocellulose before the end of 1937.

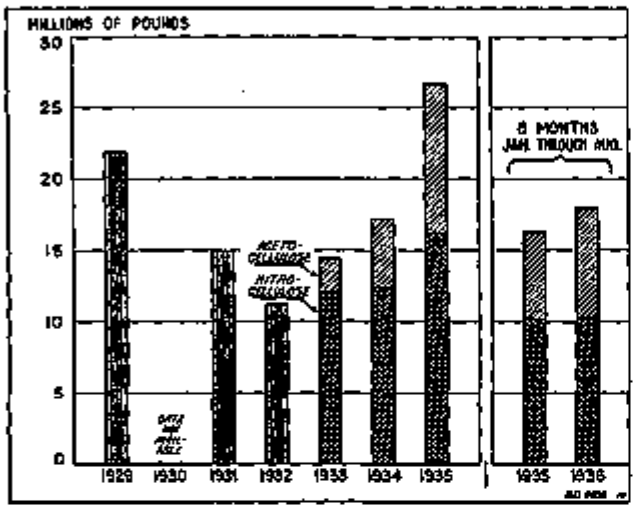

Figure 2.—Cellulose Plastic Products

NOTE.—Data for 1929 and 1931 are from the Census of Manufactures. Subsequent figures are based on monthly reports to the Bureau of the Census, from the entire industry. Data showing the two major types of plastics separately are not available prior to 1933.

Foreign Markets

Development of the plastics industries in foreign countries has not proceeded at a pace comparable with that experienced in the United States, though considerable progress has been made in recent years, particularly in the United Kingdom, Germany, France, Italy, and other European countries, as well as in Japan.

Very little plastics material is imported into the United States, but as foreign manufacturers are beginning to appreciate the utility of such products our exports are assuming considerable importance. Preliminary statistics show that during the first 7 months of the current year the value of such exports was as follows: Pyroxylin scrap, $93,000; pyroxylin plastic film base, $1,481,000; pyroxylin sheets, rods, and tubes, $266,000; cellulose acetate sheets, rods, and tubes, $211,000; nitro- and aceto-cellulose solutions, $438,000, and synthetic gums and resins, $400,000. These figures, of course, do not include finished plastic articles nor exports of plastics that go to foreign countries incorporated in such products as automobiles, radio sets, and numerous other manufactured articles.

Having attained its greatest growth during depression years, the outlook for the American plastics industry appears bright. More and more manufacturers are finding that these materials can be utilized in the manufacture of their products because of both economy and sales appeal.